CS-14: Risk and Capital Management Through ALM

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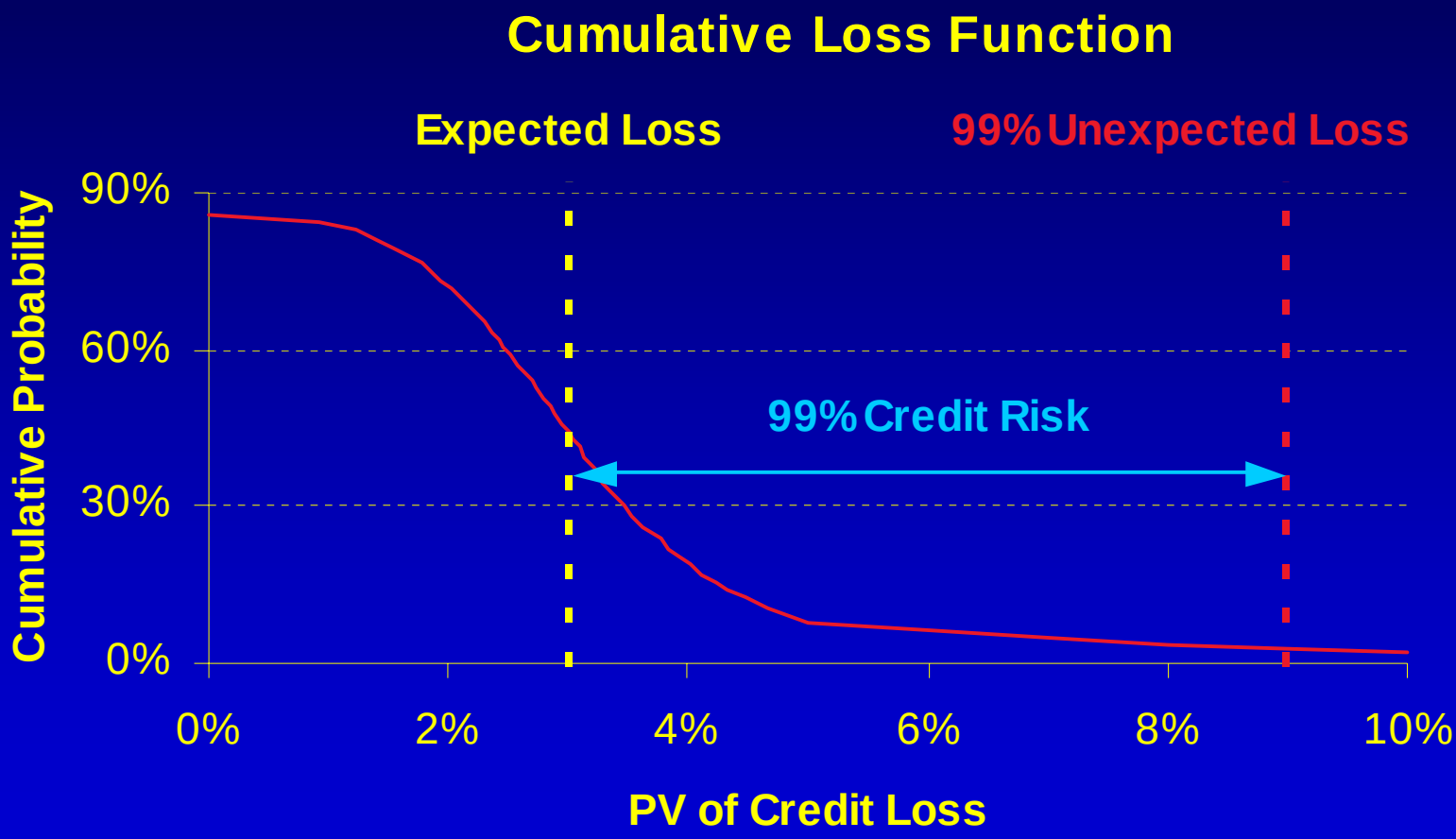
New Trends in ALM Methodologies

- Asset / Liability management received new focus when capital reserves came under pressure.
- The traditional Asset / Liability approach utilized by pension finds and life insurance companies involves managing duration and cash flows mismatch.
- This methodology defined the benchmark of investment portfolios with the main challenge of finding financial assets that could closely approximate the long duration of actuarial liabilities.
- The market current conditions (under-performing equities, historically low interest rates and the unusually high number of defaults) have shaken this traditional universe.

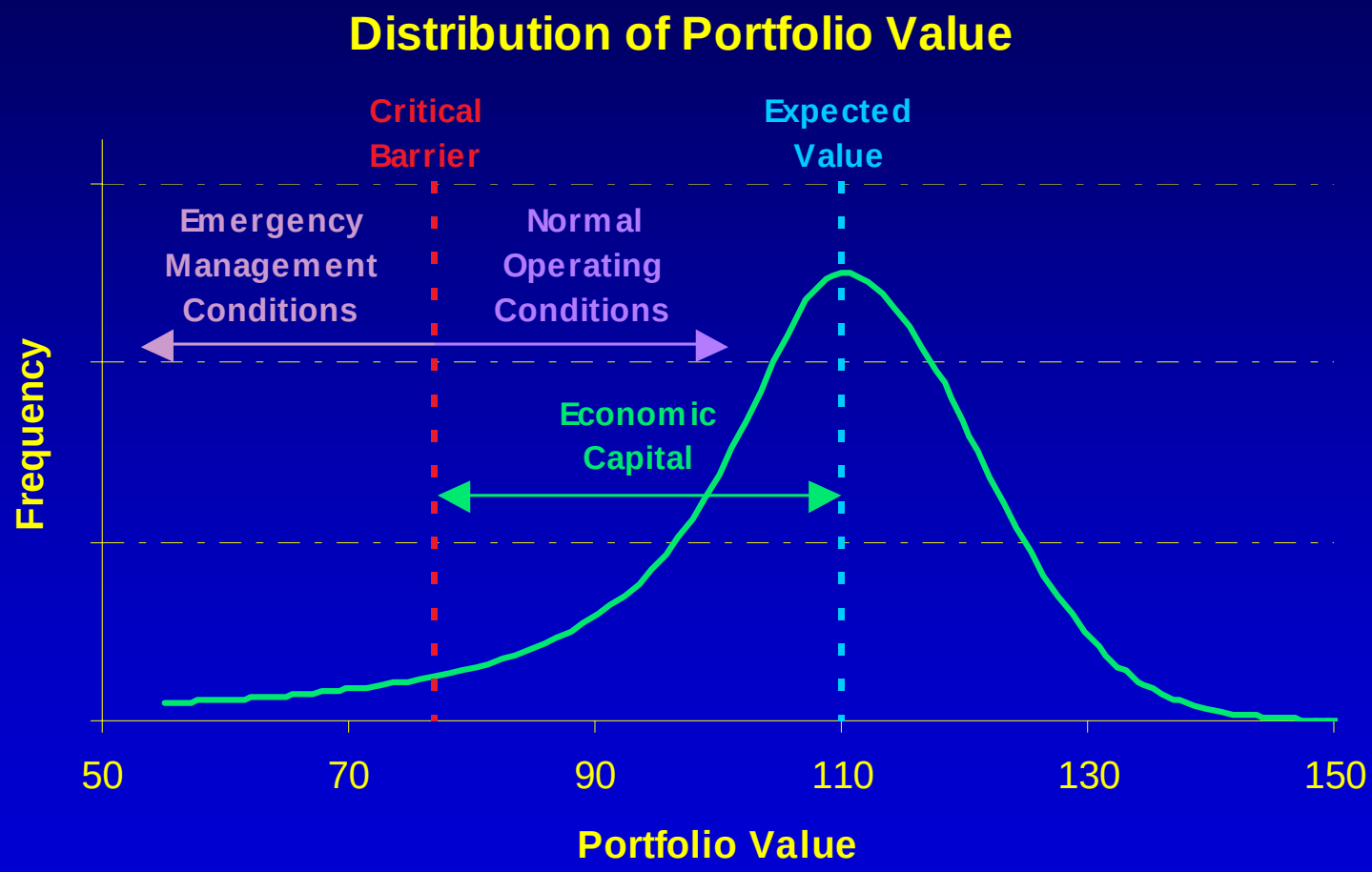
Capital-at-Risk Approach

- Senior management is focusing on the risk measures that can combine more traditional Asset / Liability and portfolio management techniques (like Duration Matching and Benchmark Tracking) with the new tendencies dictated by the current market conditions (Risk Budgeting, Value-at-Risk, Return on Economic Capital).
- Capital-at-Risk approach shows a way to:
  - Identify the risks that are inherent in the current portfolio
  - Integrate these risks considering their specific dynamics and correlations between them
  - Determine the bottom-line impact of these risks on the capital reserves and any hedging requirements that may provide the necessary level of capital protection
  - Optimize risk / return characteristics of the portfolio according to manager's specific objectives.

Measuring Credit Risk



Portfolio Distribution for Market and Credit Risk



Summary of the New ALM Approach

- ALM approach should simultaneously model uncertainties in projected cash flows on both asset and liability sides.
- It should combine market (interest rate, foreign exchange and equity) and credit risk on a consistent modeling platform.
- Assessing market and credit risk should be compatible with pricing and hedging models and methodologies.
- It should take into account the existing benchmark and investment guidelines.
- The suggested approach can serve as an overlay to existing risk management models, while consistently integrating different types of risk and providing practical solutions for risk reduction.

Modeling Net Asset MTM

- Simultaneous modeling of asset and liability side allows portfolio managers to:
  - Construct the distributions of the Net Asset Value at future time points
  - Determine which portions of these distributions might violate existing risk policies
  - Identify the duration mismatch between asset and liability sides
  - Quantify and compare different asset allocation strategies
  - Design optimal minimum cost hedges to increase return and extend duration on the asset side and thus close down the duration gap and its effect on the Net Asset Value
  - Verify the validity or provide the ground for modification of the current portfolio benchmark.

Flexibility of the Framework

- Various Asset Types
  - Traditional Investments: Domestic/International Equities and Bonds
  - Alternative Investments: Hedge Funds, Managed Futures, Private Equity
- Various Liability Types:
  - Life/Health Insurance
    - Term and Permanent Life Insurance
    - Annuities and Pensions
  - P/C Insurance
    - Personal Lines
    - Commercial Lines
  - Reinsurance
- Capture effect of various product overlays
  - “Smooth Growth”-type for the asset side
  - “Downside or collar protection”-type for the net asset value

Asset Allocation and Risk Budgeting

Asset Allocation	Risk Budgeting
Absolute increase or decrease in portfolios' sizes in dollar terms	Volatility and correlation changes
Redistribution of dollar amounts among portfolios	Responds to: Asset growth (i.e. overweight) Volatility increase Correlation movements
Static	Dynamic

Example: Modeling Various Asset Classes

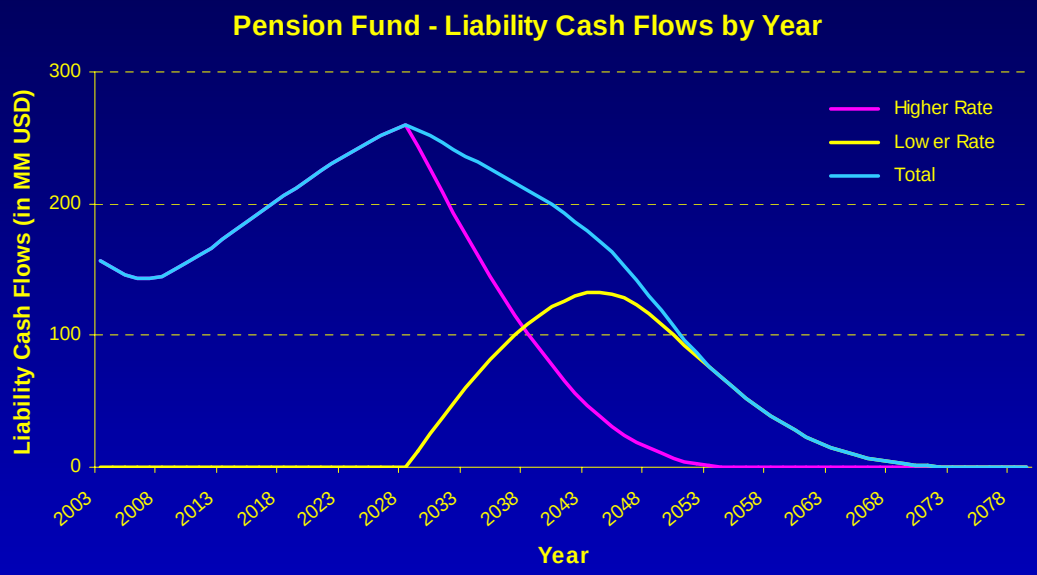
Asset Class	Notional
Cash	2.5%
US Government Bonds	14.5%
US Corporate Bonds	22.7%
US Equities	19.0%
Foreign Government Bonds	10.5%
Foreign Corporate Bonds	9.1%
Foreign Equities	8.0%
Hedge Funds	7.5%
Private Equity	6.2%

$$V_i(p,t) = V_i(0)\exp\left\{\left(\mu_i - \frac{\sigma_i^2}{2}\right)t + \sigma_i\sqrt{t}z_i\right\}$$

$$r(p,t,\nu) = \bar{r}(t,\nu)\exp\left(-\frac{\sigma_\nu^2}{2}t^2 + \sigma_\nu\sqrt{t}z_\nu\right)$$

$$A_i(p,t) = A_i(p,t-\Delta t)(1+\mu_i(p,t)\Delta t) + \omega_i[I(p,t) - \lambda(p,t)]$$

Example: Modeling Actuarial Liabilities



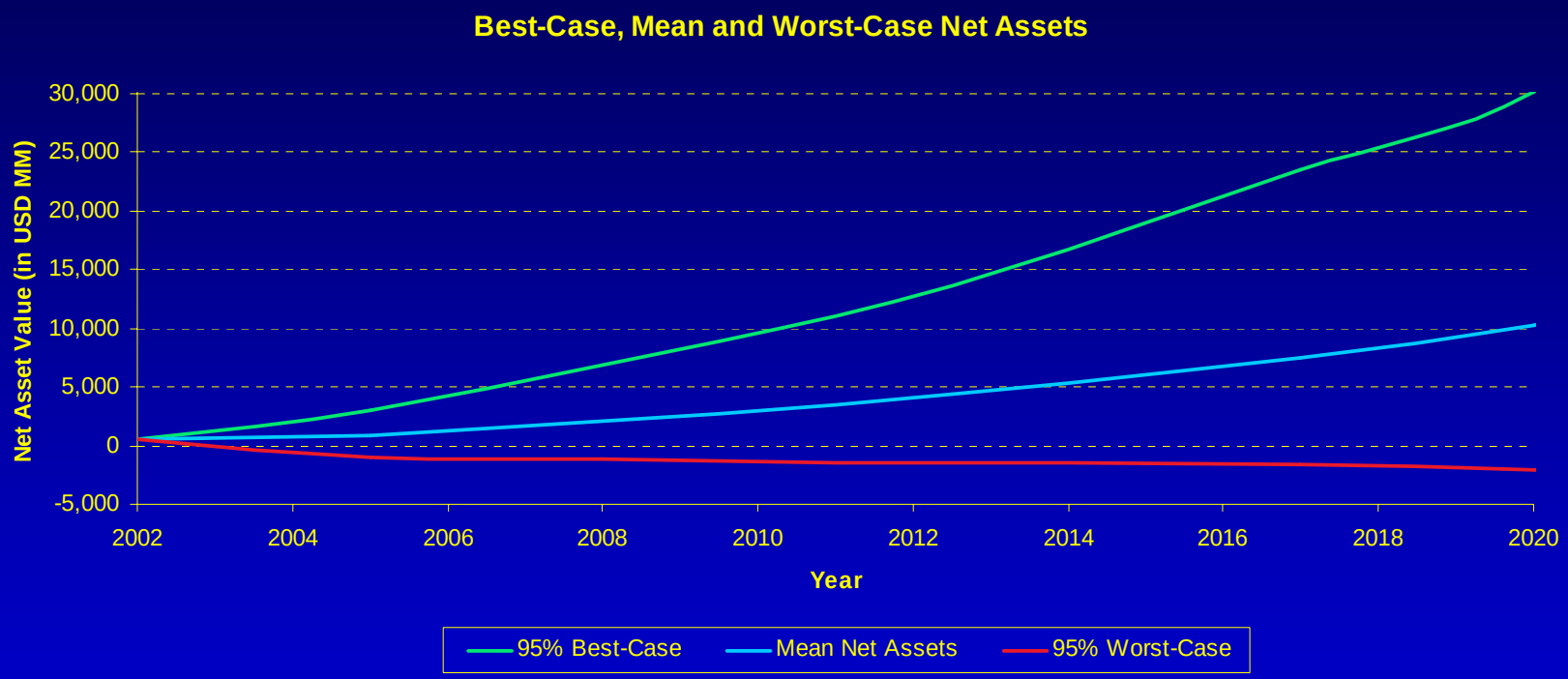
$$\Lambda(p,t) = N(p,t) + S(p,t) + I(p,t) - \lambda(p,t)$$

$$N(t) = N(t-\Delta t)(1 + \max[\bar{a}(t) + h, r]\Delta t)$$

$$S(t) = S(t-\Delta t)(1 + r\Delta t)$$

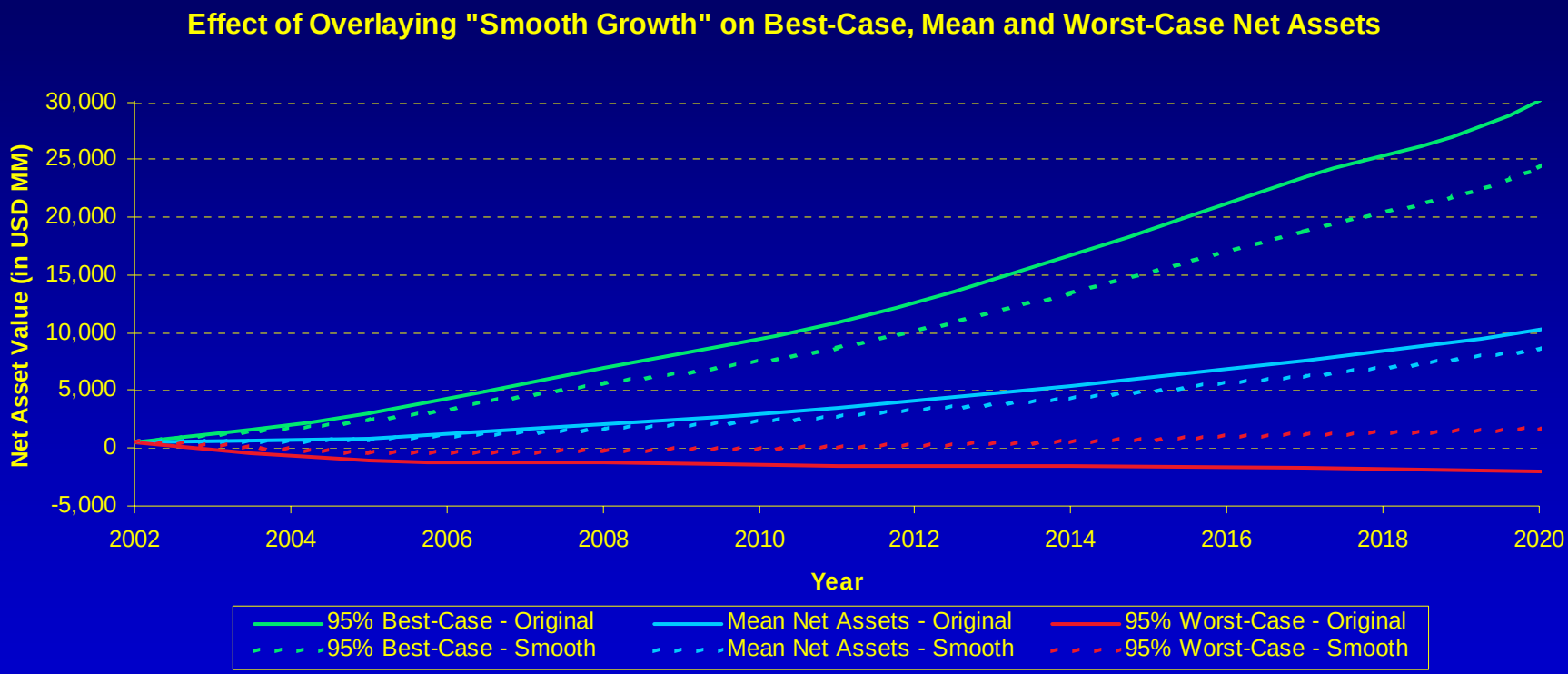
$$N(p,t) = \alpha(t)\Lambda(p,t); \quad S(p,t) = (1-\alpha(t))\Lambda(p,t)$$

Example: Base Case



Year	2002	2005	2008	2011	2014	2017	2020	2023	2026
95% Best-Case Net Asset Value	506	3,019	6,918	10,943	16,774	23,544	30,158	45,759	60,942
Average Net Asset Value	506	881	2,095	3,486	5,327	7,546	10,317	14,249	19,545
95% Worst-Case Net Asset Value	506	-1,013	-1,205	-1,469	-1,476	-1,678	-2,051	-2,440	-3,144
Probability of Falling Below 0	0.0%	26.0%	20.0%	18.0%	14.1%	12.2%	10.0%	9.6%	9.4%

Example: Effect of “Smooth Growth”



Example: Capital Cost of Embedded Floors

		Year	2002	2005	2008	2011	2014	2017	2020	2023	2026
Initial Assets	10,000	95% Best-Case Net Asset Value	506	3,019	6,918	10,943	16,774	23,544	30,158	45,759	60,942
Initial Liabilities	9,524	Average Net Asset Value	506	881	2,095	3,486	5,327	7,546	10,317	14,249	19,545
Guaranteed Rate	4%	95% Worst-Case Net Asset Value	506	-1,013	-1,205	-1,469	-1,476	-1,678	-2,051	-2,440	-3,144
		Probability of Falling Below 0	0.0%	26.0%	20.0%	18.0%	14.1%	12.2%	10.0%	9.6%	9.4%

		Year	2002	2005	2008	2011	2014	2017	2020	2023	2026
Initial Assets	10,000	95% Best-Case Net Asset Value	506	3,505	7,527	11,970	17,955	25,487	33,082	48,339	64,622
Initial Liabilities	9,524	Average Net Asset Value	506	1,311	2,696	4,281	6,387	8,936	12,129	16,603	22,637
Guaranteed Rate	0%	95% Worst-Case Net Asset Value	506	-544	-672	-781	-807	-755	-795	-898	-979
		Probability of Falling Below 0	0.0%	14.4%	12.5%	10.9%	8.3%	7.5%	6.3%	6.3%	6.1%

		Year	2002	2005	2008	2011	2014	2017	2020	2023	2026
Initial Assets	10,410	95% Best-Case Net Asset Value	917	3,595	7,785	12,123	18,444	26,117	33,190	49,796	66,871
Initial Liabilities	9,524	Average Net Asset Value	917	1,360	2,708	4,275	6,359	8,886	12,056	16,538	22,600
Guaranteed Rate	4%	95% Worst-Case Net Asset Value	917	-621	-769	-964	-772	-857	-980	-1,055	-1,282
		Probability of Falling Below 0	0.0%	14.4%	13.6%	12.1%	9.0%	8.2%	7.0%	6.7%	6.3%

Conclusions

- The described approach introduces an efficient way of managing capital reserves as the global objective of any ALM platform.
- It can be used for identifying the appropriate benchmarks and constructing new investment portfolios to reflect changing market environment and investment objectives.
- This methodology also allows managers to measure mark-to-market risk in the portfolio while at the same time quantifying the effect of hedging strategies.
- The discussed methodology analyzes risk/return characteristics of existing portfolios and identifies broad parameters of an optimal portfolio.